



Illinois Department of Transportation

To: Keith Roberts Attn: Kirk H. Brown
From: Jack A. Elston By: Michael Brand *Michael Brand*
Subject: Pavement Design Approval
Date: December 16, 2019

Route: FAI 57 (I-57)
Section: 61-(1,1-1,1-2,2)RS-1
County: Marion
Contract: 76F79
D-98-064-12
Limits: Jefferson County Line to 0.7 miles North of IL 161

We have reviewed the pavement design for the above referenced project which was most recently submitted on December 13, 2019. The scope of the project involves reconstructing the I-57 mainline pavement and portions of the ramps for the IL 161 interchange.

Since the traffic factor for this section of I-57 exceeds 60, we concur with the district that the pavement design qualifies as a "special design" and the use of continuously reinforced concrete pavement is warranted. We also concur with the decision to not consider rubblization or an unbonded concrete overlay due to the existing fore slopes and condition of the existing pavement.

In summary the approved pavement designs are as follows:

I-57 Reconstruction

11.75" CRC w/PCC Shoulders
4" HMA Stabilized Subbase
12" Improved Subgrade

IL 161 Interchange Ramps

9" PCC w/PCC Shoulders
4" Stabilized Subbase
12" Improved Subgrade

If you have any questions, please contact Mike Brand at (217) 782-7651.



Illinois Department of Transportation

Memorandum

To:	Herve Gelin ⁴⁵	Attn.: Robert Harbaugh
From:	Tim Padgett	By: Drew Ruholl
Subject:	Pavement Design	
Date:	November 21, 2019	

FAI 57 (I-57)
Section 61-(1,1-1,1-2,2)RS-1
Marion County
D-98-064-12
Contract No. 76F79

Reconstruction and Bridge Repair along I -57 from the Jefferson County Line to 0.7 Mi N of IL 161

The subject project consists of reconstructing mainline I-57 from the Jefferson County Line to 0.7 miles north of IL Route 161. The scope of work requires the mainline pavement to be reconstructed. In addition, part of the ramps for the IL 161 interchange will be constructed as well. Separate pavement designs were performed for the mainline pavement and the IL 161 ramps.

Project Information (I-57 Mainline)

Two designs were evaluated for the mainline reconstruction. Since the rigid traffic factor for this section of I-57 is above 60, a CRCP pavement is required. Two pavement designs using a CRCP pavement designs were evaluated. The first was a CRCP pavement which replaces the existing CRCP pavement. The second was a CRCP UCO. However, upon further review by the Bureau of Research, it was determined that a typical UCO was not recommended due to the extensive D-cracking and the amount of patching that has been performed and will need to be performed in the existing pavement. In addition, there are existing fore slopes steeper than 1:4 which will be reconstructed to a 1:6. A typical UCO raises the elevation of the proposed pavement, which will also increase the amount of earth work and could cause potential ROW impacts. For these reasons, the CRCP UCO was not evaluated further. Therefore, the proposed pavement design is a CRCP pavement with a bituminous stabilized subbase and improved subgrade. No LCCA was performed for the mainline pavement design since the rigid traffic factor was greater than 60.

- I-57 designated as an Interstate
- Approximately 105,400 square yards of new pavement. Since it is more than 4,750 square yards, BDE approval is required.
- 11.75" CRCP pavement with a 4" Bituminous stabilized subbase is proposed.

- A 12" improved subgrade is proposed. This will be subject to change during the RGR.
- Lane widths are 12'. Shoulder widths are 6' for the inside shoulders and 12' for the outside shoulders.
- Existing roadway will be removed within the project limits.
- Rigid TF>60 so LCCA is not required.

Project Information (IL-161 Interchange Ramps)

The mechanistic structural pavement design methodology was used for the IL 161 ramps. Since a rigid pavement is being used for the mainline pavement and the ramps are connected to the entrance and exit ramps, the ramps shall be JPCP. Since the ramps need to be JPCP to match the rigid mainline pavement, no LCCA was performed.

- The IL Route 161 ramps are designated as an Interstate.
- IL Route 161 (crossroad) is designated as an Other Arterial.
- Approximately 10,280 square yards of new pavement. Since it is more than 4,750 square yards, BDE approval is required.
- Lane widths are 16'. Shoulders width are 10' for the outside shoulders and 8' for the inside shoulders.
- 9" JPCP pavement with a 4" stabilized subbase is proposed.
- A 12" improved subgrade was proposed. This will be subject to change during the RGR.

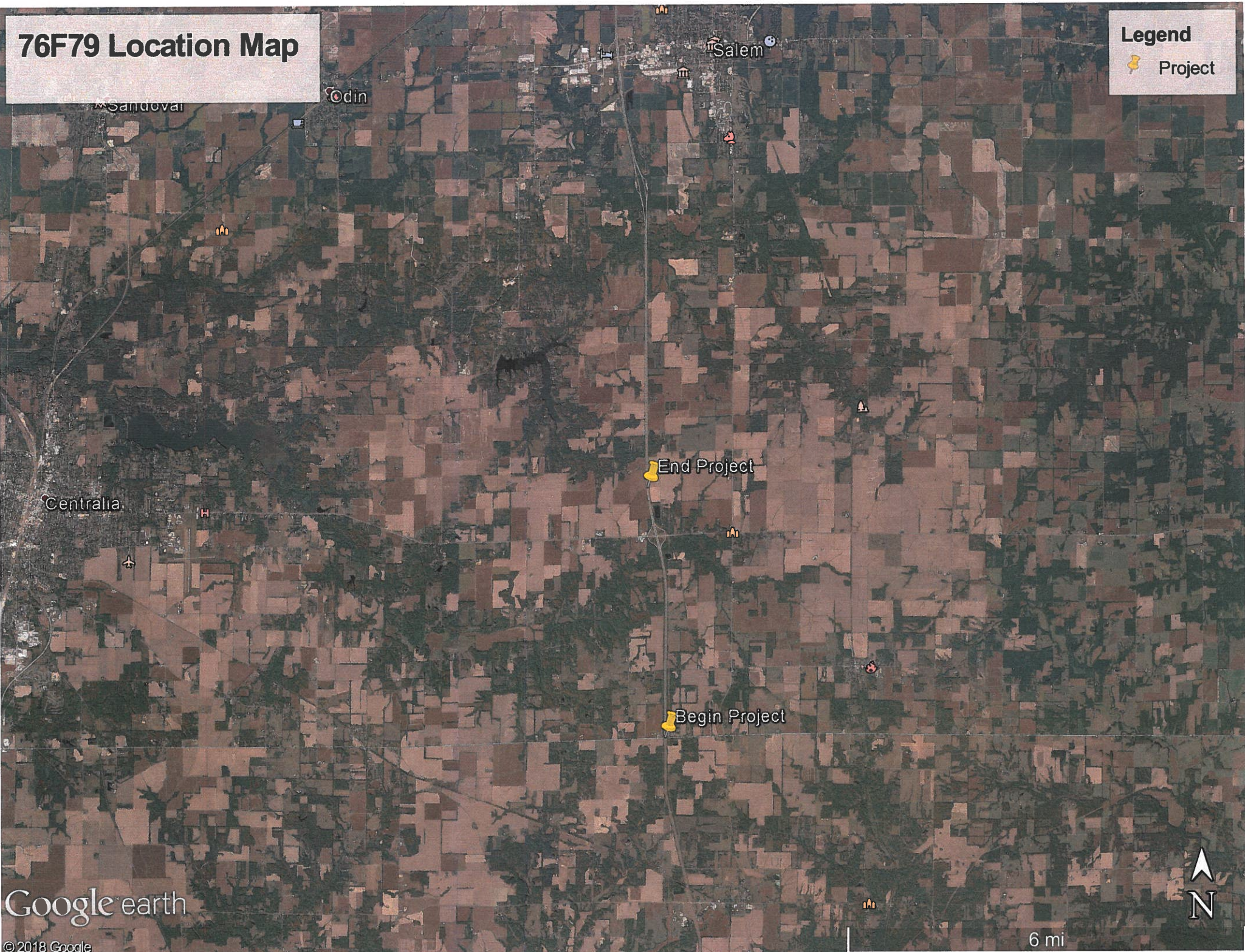
The proposed pavement for mainline I-57 is 11.75" of CRCP pavement with 4" of stabilized subbase and 12" of improved subgrade. The proposed improved subgrade will be subject to change during the development of the RGR. The existing pavement will be removed.

The proposed pavement for the IL 161 ramps is 9" JCPC pavement with a 4" stabilized subbase and 12" of improved subgrade. No flexible pavements were evaluated for the IL 161 ramps since the mainline pavement design is a rigid pavement and the ramps are connected to the exit and entrance terminals.

If you have any questions or comments, please contact Drew Ruholl at (618) 346-3454.

76F79 Location Map

Legend
Project

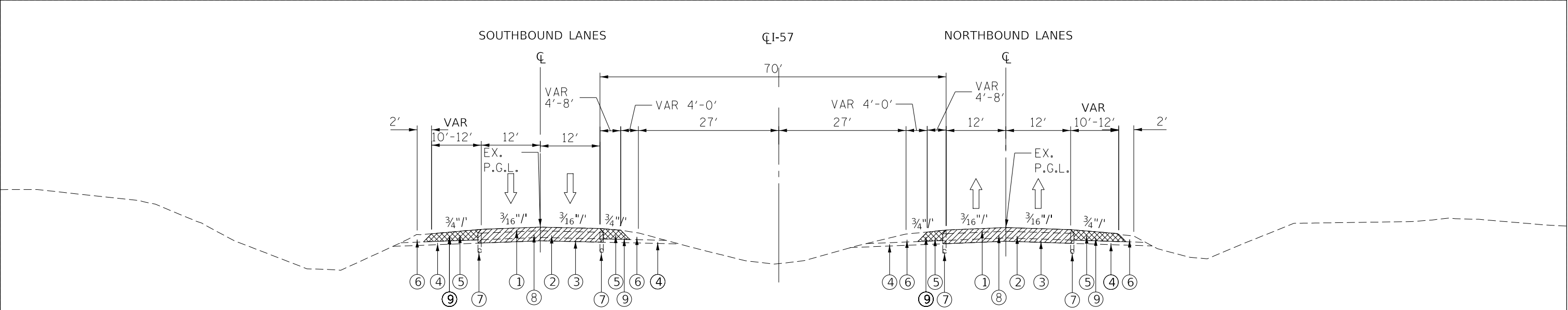


Google earth

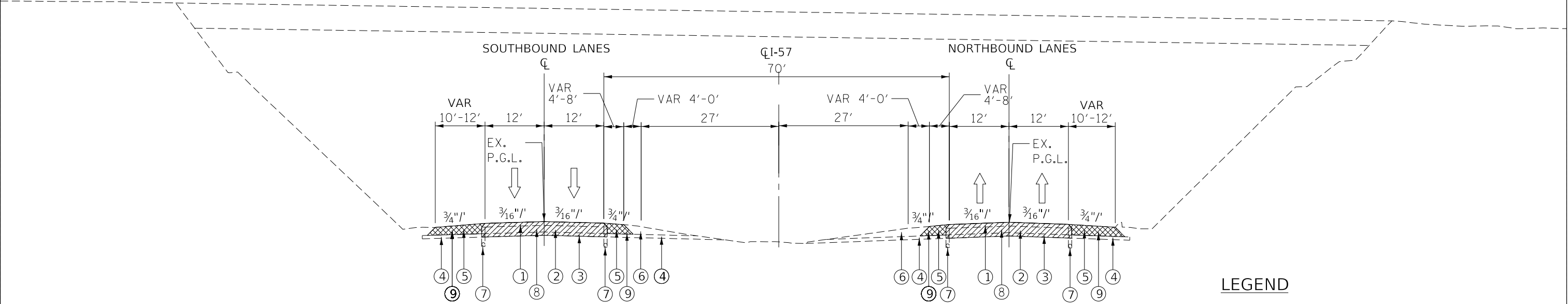
© 2018 Google



6 mi



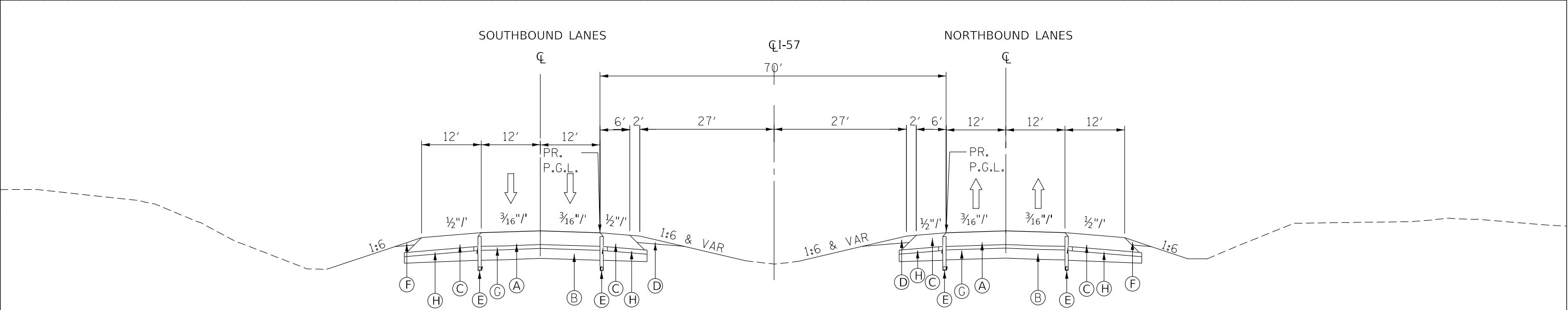
EXISTING TYPICAL SECTION



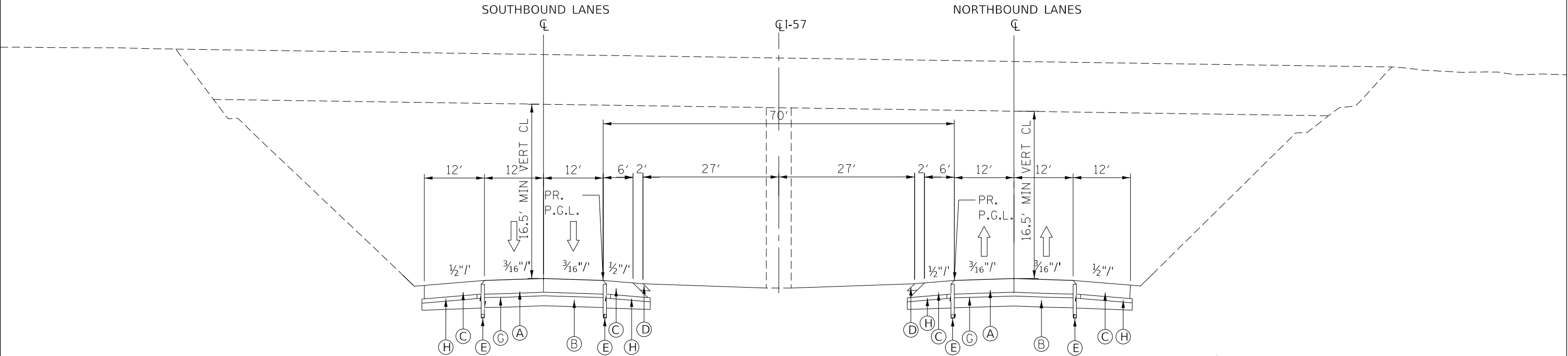
EXISTING TYPICAL SECTION - UNDER BRIDGE

LEGEND

- ① EXISTING H.M.A. SURFACING (4 1/2")
- ② EXISTING C.R.P.C.C. PAVEMENT (8")
- ③ EXISTING STABILIZED SUB-BASE BITUMINOUS AGGREGATE MIXTURE (4")
- ④ EXISTING SUB-BASE GRANULAR MATERIAL, TYPE C (4")
- ⑤ EXISTING H.M.A. SHOULDERS (12 1/2")
- ⑥ EXISTING AGGREGATE SHOULDER WEDGE
- ⑦ EXISTING PIPE UNDERDRAINS (4")
- ⑧ EXISTING PAVEMENT REMOVAL
- ⑨ EXISTING HMA SHOULDER REMOVAL



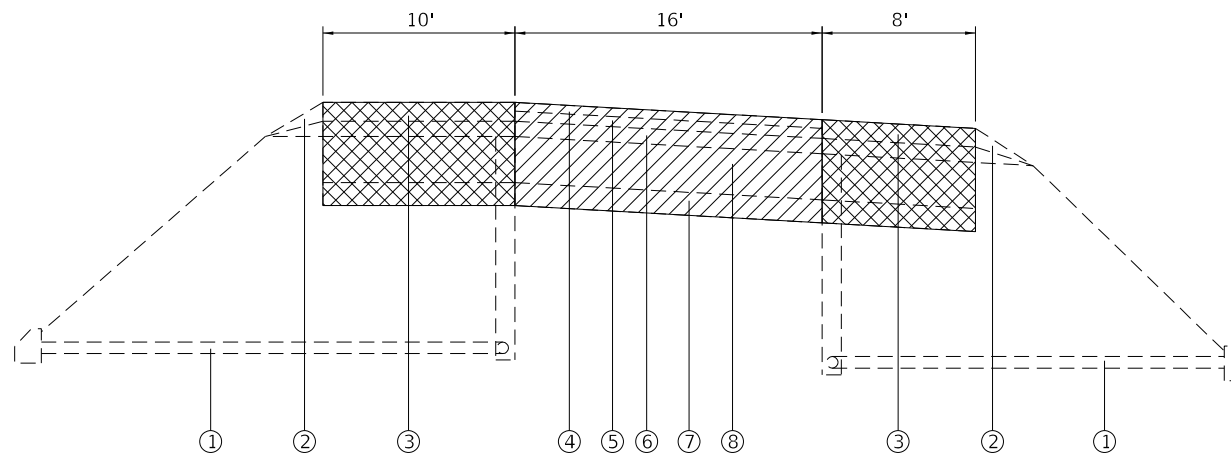
PROPOSED TYPICAL SECTION



PROPOSED TYPICAL SECTION - UNDER BRIDGE

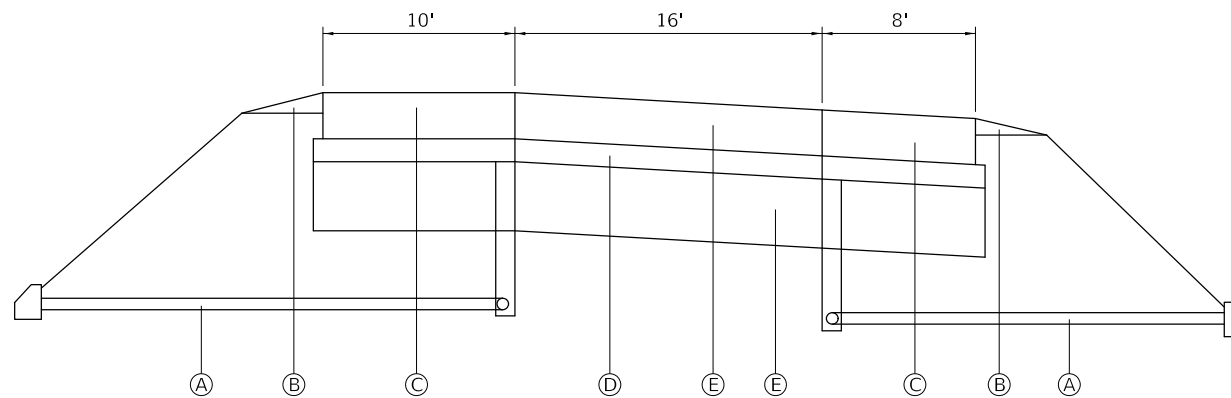
LEGEND

- (A) PROPOSED CONTINUOUSLY REINFORCED P.C.C. PAVEMENT (11 3/4")
- (B) PROPOSED AGGREGATE SUBGRADE IMPROVEMENT (12")
- (C) PROPOSED PCC SHOULDER
- (D) PROPOSED AGGREGATE SHOULDER
- (E) PROPOSED PIPE UNDERDRAINS
- (F) PROPOSED AGGREGATE WEDGE
- (G) PROPOSED STABILIZED SUBBASE - HMA, 4"
- (H) PROPOSED SUBBASE GRANULAR MATERIAL, TYPE C



EXISTING TYPICAL

INTERCHANGE RAMPS A, B, C, AND D



PROPOSED TYPICAL

INTERCHANGE RAMPS A, B, C, AND D

LEGEND

- ① EXISTING PIPE UNDERDRAINS 4" (TYP)
- ② EXISTING AGGREGATE SHOULDERS TYPE B
- ③ EXISTING BITUMINOUS SHOULDERS
- ④ EXISTING POLYMER BITUMINOUS CONCRETE SURFACE COURSE SUPERPAVE "D" N105 (1½")
- ⑤ EXISTING POLYMER BITUMINOUS CONCRETE BINDER COURSE SUPERPAVE IL-19, N105 (1¾")
- ⑥ EXISTING BITUMINOUS RESURFACING (VARIABLE DEPTH)
- ⑦ EXISTING STABILIZED SUBBASE 4"
- ⑧ EXISTING CRPCC PAVEMENT 8"
- Ⓐ PROPOSED PIPE UNDERDRAINS 4" (TYP)
- Ⓑ PROPOSED AGGREGATE SHOULDERS TYPE B
- Ⓒ PROPOSED PCC SHOULDERS 9.5"
- Ⓓ PROPOSED STABILIZED SUBBASE 4"
- Ⓔ PROPOSED JOINTED PCC PAVEMENT 9"
- Ⓕ PROPOSED AGGREGATE SUBGRADE IMPROVEMENT 12"

USER NAME = ruholids PLOT SCALE = 100.0000' / in. PLOT DATE = 12/11/2019	DESIGNED - _____	REVISED - _____	<div style="text-align: center;"> STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION </div>	<div style="text-align: center;"> IL ROUTE 161 INTERCHANGE RAMPS TYPICAL SECTIONS </div>	F.A.I. RTE. _____	SECTION 61-(1,1-1,2,2)RS-1	COUNTY MARION	TOTAL SHEETS _____	SHEET NO. _____
	DRAWN - _____	REVISED - _____			CONTRACT NO. 76F79				
	CHECKED - _____	REVISED - _____							
	DATE - _____	REVISED - _____							
SCALE: _____ SHEET _____ OF _____ SHEETS STA. _____ TO STA. _____									

(Enter Data in Gray Shaded Cells)

Route: I-57	Comments: Mainline w/ Overhead Structures														
Section: 61-(1,1-1,1-2,2)RS-1															
County: Marion	Design Date: 11/19/2018	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="text-align: left;"><-- BY</td> </tr> <tr> <td style="width: 30%; text-align: left;"><-- BY</td> <td style="width: 30%; text-align: center;">ADT</td> <td style="width: 40%; text-align: center;">Year</td> </tr> <tr> <td>Current:</td> <td style="color: blue;">22,400</td> <td style="color: blue;">2017</td> </tr> <tr> <td>Future:</td> <td style="color: blue;">26,300</td> <td style="color: blue;">2035</td> </tr> </table>		<-- BY			<-- BY	ADT	Year	Current:	22,400	2017	Future:	26,300	2035
<-- BY															
<-- BY	ADT			Year											
Current:	22,400			2017											
Future:	26,300	2035													
Location: Jefferson Co. Line to 0.7 mi N of IL 161	Modify Date:														
Facility Type: Interstate or Freeway															
# of Lanes = 4															
Road Class: I															
Subgrade Support Rating (SSR): Poor															
Construction Year: 2021															
Design Period (DP) = 20 years															

FLEXIBLE PAVEMENT

Cpv = 0.15
Csu = 132.5
Cmu = 482.53

TF flexible (Actual) = 45.08 (Actual ADT)
TF flexible (Min) = 7.11 (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15
Csu = 143.81
Cmu = 696.42
TF rigid (Actual) = 64.82 (Actual ADT)
TF rigid (Min) = 10.05 (Min ADT Fig. 54-2.C)

Full-Depth HMA Pavement

Use TF flexible =	45.08	
PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)
HMA Mixture Temp. =	79.5	deg. F (Fig. 54-5.C)
Design HMA Mixture Modulus (E_{HMA}) =	570	ksi (Fig. 54-5.D)
Design HMA Strain (ϵ_{HMA}) =	41	(Fig. 54-5.E)
Full Depth HMA Design Thickness =	17.50	in. (Fig. 54-5.F)
Limiting Strain Criterion Thickness =	16.50	in. (Fig. 54-5.I)
Use Full-Depth HMA Thickness =	16.50	inches

JPC Pavement

Use TF rigid =	64.82	
Edge Support =	Tied	Shoulder or C.&G.
rigid Pavt Thick. =	11.50	in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid =	64.82
IBR value =	3
CP Thickness =	11.75 in. (Fig. 54-4 M)

HMA Overlay of Rubblized PCC

Use TF flexible =	45.08	
HMA Overlay Design Thickness =	14.50	in. (Fig. 54-5.U)
Limiting Strain Criterion Thickness =	11.75	in. (Fig. 54-5.V)
Use HMA Overlay Thickness =	11.75	inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

CRCP Thickness = 10.75 inches

Class | Roads

4 lanes or more
Part of a future 4 lanes or more
One-way Streets with ADT > 3500

Class II Roads

2 lanes with ADT > 2000
One way Street with ADT <= 3500

Class III Roads

2 Lanes
(ADT 750 -2000)

Class IV Roads

2 Lanes
(ADT < 750)

	Min. Str. Design Traffic (Fig 54-2.C)		
Facility Type	PV	SU	MU
Interstate or Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
Number of Lanes	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: I-57	Comments: IL 161 Interchange Ramps		
Section: 61-(1,1-1,1-2,2)RS-1	Design Date: 08/20/2019	<-- BY <-- BY Current: 1,450 2017 Future: 1,700 2035	
County: Marion	Modify Date:		
Location: Jefferson Co. Line to 0.7 mi N of IL 161			
Facility Type: Interstate or Freeway	** Ramp Design Fig. 54-1.B **		
# of Lanes = 1 Lane Ramp	Crossroad? Other Marked State Route		
Road Class: I	# of Lanes = 2 or 3		
Subgrade Support Rating (SSR): Poor			
Construction Year: 2020			
Design Period (DP) = 20 years			
	Struct. Design ADT = 1,631 (2030)		

FLEXIBLE PAVEMENT		RAMP DESIGN MIN		RIGID PAVEMENT		RAMP DESIGN MIN	
Cpv =	0.15	0.15	50%	Cpv =	0.15	0.15	50%
Csu =	132.5	112.06	50%	Csu =	143.81	135.78	50%
Cmu =	482.53	385.44	50%	Cmu =	696.42	567.21	50%
TF flexible (Actual) =	1.13	(Actual ADT)	3.17	TF rigid (Actual) =	1.50	(Actual ADT)	4.59
TF flexible (Min) =	3.17	(Min ADT Fig. 54-2.C)		TF rigid (Min) =	4.59	(Min ADT Fig. 54-2.C)	

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement		JPC Pavement	
Use TF flexible =	3.17	Use TF rigid =	4.59
PG Grade Lower Binder Lifts =	PG 64-22 (Fig. 53-4.R)	Edge Support =	Tied Shoulder or C.&G.
HMA Mixture Temp. =	79.5 deg. F (Fig. 54-5.C)	Rigid Pavt Thick. =	9.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E _{HMA}) =	570 ksi (Fig. 54-5.D)		
Design HMA Strain (E _{HMA}) =	86 (Fig. 54-5.E)		
Full Depth HMA Design Thickness =	11.00 in. (Fig. 54-5.F)		
Limiting Strain Criterion Thickness =	16.50 in. (Fig. 54-5.I)		
Use Full-Depth HMA Thickness =	11.00 inches	CRCP Thickness =	8.00 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC		Unbonded Concrete Overlay	
Use TF flexible =	3.17	Review 54-4.03 for limitations and special considerations.	
HMA Overlay Design Thickness =	7.75 in. (Fig. 54-5.U)		
Limiting Strain Criterion Thickness =	11.75 in. (Fig. 54-5.V)		
Use HMA Overlay Thickness =	7.75 inches	JPCP Thickness =	NA inches

CONTACT BMPPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 -2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU*	MU*
Interstate or Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	0	250	750

* Use marked route minimums for unmarked routes (Fig. 54-1.B)

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)						
Number of Lanes	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%